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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/571,475

02/12/2007

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EXAMINER

RIDDLE, CHRISTINA A

ART UNIT

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2851

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/571,475	KOEHLER ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Christina Riddle	2851	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 47, 49-66 and 68-91 is/are pending in the application.
- 4a) Of the above claim(s) 49-52, 62, 68-79 and 81-91 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 47, 53-59, 61, 63-66 and 80 is/are rejected.
- 7) ☒ Claim(s) 47, 63, and 80 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 2/12/2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>3/13/2006, 2/12/2007, 8/9/2007, 8/4/2008</u> .                | 6) <input type="checkbox"/> Other: _____                          |



## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election without traverse of Group I, Species I in the reply filed on 4/13/2009 is acknowledged.

Applicant listed claims 47, 53-59, 61, 63-66, and 80 in Applicant's response to the election as being readable on the elected invention.

Accordingly, claims 47, 53-59, 61, 63-66, and 80 being readable on the elected invention of Group I, Species I, are presently considered under examination.

Thus claims 49-52, 62, 68-79, 81-91 are drawn to non-elected inventions and have been withdrawn from further consideration by the examiner.

### ***Priority***

2. Acknowledgment is made of applicant's claim for priority under 35 U.S.C. 119(a)-(d) based upon an application filed in Germany on 9/12/2003. A claim for priority under 35 U.S.C. 119(a)-(d) cannot be based on said application, since the United States application was filed more than twelve months thereafter.

### ***Information Disclosure Statement***

3. The information disclosure statement filed 3/13/2006 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. It has been placed in the application file, but the information referred to therein has not been considered. There is neither an explanation of relevance nor any English translation for JP 11-3849. Furthermore, there is neither an explanation of relevance nor any English text submitted with EP 0747772; however, this reference has been considered since Wangler et al. (US Patent No. 6,285,443) is an English language equivalent and was submitted with an IDS dated 8/4/2008.

4. Furthermore, the information disclosure statement filed 2/12/2007 appears to include a reference that seems to be misidentified. WO 01/36470 does not seem to be relevant to the instant application. Instead the examiner has cited WO 00/36470 in the attached PTO-892 form.

### ***Specification***

The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

#### **Arrangement of the Specification**

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in

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upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) TITLE OF THE INVENTION.
- (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.
- (e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC.
- (f) BACKGROUND OF THE INVENTION.
  - (1) Field of the Invention.
  - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (g) BRIEF SUMMARY OF THE INVENTION.
- (h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
- (i) DETAILED DESCRIPTION OF THE INVENTION.
- (j) CLAIM OR CLAIMS (commencing on a separate sheet).
- (k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
- (l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

### ***Claim Objections***

- 5. Claims 47, 63, and 80 are objected to because of the following informalities.
  - a. Claim 47, line 7, "the light distribution system" should be changed to --the light distribution device--.
  - b. Claim 47, line 10, "the angular distribution of the light" should be changed to --an angular distribution of the light--.
  - c. Claim 63, line 3, "the individual mirror" should be changed to --the individual mirrors--.

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- d. Claim 80, line 2, "no fly's eye condenser nor any integrator rod" should be changed to --neither a fly's eye condenser nor any integrator rod--.

Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 47, 53, 54, 55, 56, 57, 61, 63, 65, and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singer (US PGPub 2002/0136351) in view of Wangler et al. (US Patent No. 6,285,443, referred to as Wangler hereinafter).

**Regarding claims 47, 53, 54, 56, 57, 61,** Singer discloses an illumination system (Figs. 5a-b) for a microlithography projection exposure system (EUV illumination system, Fig. 10) for illuminating an illumination field (reticle, exit pupil 24, or object 108, Fig. 10) with light from a primary light source (light source 1, Fig. 10), comprising: a light distribution device (Figs. 5a-b) configured to receive light from the primary light source and to produce a two-dimensional intensity distribution (Figs. 6-9 for example show two-dimensional intensity distributions) in a pupil-shaping surface (pupil raster element plate 10, Figs. 5a-b) of the illumination system, wherein the light distribution system is configured to variably set the two-dimensional intensity distribution, wherein the light

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distribution device has at least one optical modulation device (field raster element plate 7, Figs. 5a-b) configured to controllably change the angular distribution of the light incident on the optical modulation device (paras. [0075] and [0079], the tilt angle of field raster elements 5 can be changed with actuators), wherein the optical modulation device comprises an array of individual elements (field raster elements 5, Figs. 5a-b) that are driven individually to change an angle of radiation incident on the individual elements (paras. [0075] and [0079], field raster elements 5 are individually controllable via actuators to change their tilt angles), and wherein, between the light source and the optical modulation device, there is arranged an optical device (collector mirror, 3, Figs. 5a-b) which concentrates radiation incident on the optical device onto the individual elements of the optical modulation device. Singer further discloses wherein the optical modulation device is a reflective optical modulation device (Figs. 5a-b and para. [0074], raster elements 5 are reflective). Singer further discloses wherein the reflective optical modulation device is arranged obliquely with respect to an optical axis in the manner of a deflection mirror (Figs. 5a-b, field raster element plate 7 is angled with respect to the optical axis as indicated by the direction of the collector mirror 3). Singer further discloses wherein the individual elements of the optical modulation device comprise an array of individual mirrors in at least one mirror arrangement (Figs. 5a-b, field raster element plate 7 is formed from raster elements 5). Singer further discloses wherein at least some of the individual mirrors have a flat mirror surface (Figs. 5a-b, raster elements 5 have flat mirror surfaces). Singer further discloses wherein the individual mirrors of the mirror arrangement all have the same shape and size (Figs. 5a-b and 6a,



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field raster elements have the same size and shape and Fig. 6a shows a top view of raster element plate 7 with 72 raster elements). However, Singer does not explicitly describe wherein an axicon system is arranged between the optical modulation device and the pupil-shaping surface.

However, Wangler discloses wherein an axicon system (axicon pair 21, Fig. 1) is arranged between the optical modulation device and the pupil-shaping surface (Fig. 1, axicon pair is between first raster element 9 and second raster element 8).

It would have been obvious to one skilled in the art at the time of the invention to have included an axicon as taught by Wangler, with the illumination system taught by Singer since, as shown by Wangler, an axicon in an illumination system is commonly used to adapt annular illumination, thereby achieving a desired illumination distribution (col. 4, lines 38-42).

**Regarding claim 55**, although Singer further discloses wherein, between the optical modulation device and the pupil-shaping surface, there is an optical distance such that there are angles between an optical axis and light beams belonging to the angular distribution in the region of the pupil-shaping surface (paras. [0075] and [0079], field raster elements 5 can be tilted to change the angle of incidence so that there is an angle of incidence upon the pupil raster elements 9).

However, Singer does not explicitly disclose wherein the angles are less than 5°.

Thus, since Singer discloses that the light beams are angled with respect to the optical axis in the region of the pupil-shaping surface and these light beams can be angled by field raster elements whose tilts are controllable via actuators, it would have

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been obvious to have the angles set less than 5° since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only ordinary skill in the art. *In re Aller*, 105 USPQ 233.

**Regarding claim 63**, Singer further discloses wherein at least some of the individual mirrors of the mirror arrangement have an optical structure (Figs. 5a-b, pupil raster element plate 10) which forms a distribution of the radiation reflected from the individual mirror (Figs. 6b1-6b3 show illumination distributions on pupil raster elements from light reflected by field raster elements 5).

**Regarding claim 65**, Singer further discloses wherein some individual mirrors of the mirror arrangement are tilted relative to other individual mirrors of the mirror arrangement (paras. [0075] and [0079], field raster elements 5 are individually controllable via actuators to change their tilt angles).

**Regarding claim 80**, Singer further discloses wherein neither fly's eye condenser nor any integrator rod is arranged between the pupil-shaping surface and a plane of the illumination field (Figs. 5a-b, no fly's eye condenser nor an integrator rod is included in the beam path between pupil raster element plate 10 and normal-incidence field mirror 12.1).

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8. Claims 58 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singer as modified by Wangler as applied to claim 56 above, and further in view of Schultz et al. (US Patent No. 6,438,199, referred to as Schultz hereinafter).

**Regarding claims 58 and 59,** Singer as modified by Wangler does not explicitly describe wherein at least some of the individual mirrors are curved mirrors with a finite mirror focal length, and wherein the mirror focal length is dimensioned such that radiation incident on the individual mirrors strikes the pupil-shaping surface in substantially focused form.

However, Schultz discloses wherein at least some of the individual mirrors are curved mirrors with a finite mirror focal length (col. 29, lines 39-50 and Fig. 70, convex field raster elements 7009 are designed to generate point-like light sources on later optical elements, thus the elements have a finite mirror focal length), and wherein the mirror focal length is dimensioned such that radiation incident on the individual mirrors strikes the pupil-shaping surface in substantially focused form (col. 29, lines 39-50 and Fig. 70, convex field raster elements 7009 generate point-like sources on pupil raster elements 7015, thus the convex raster elements 7009 are positioned to focus radiation on the elements at the pupil).

It would have been obvious to one skilled in the art at the time of the invention to have included elements with curved mirrors as taught by Schultz, in the illumination system taught by Singer as modified by Wangler since curved mirrors are commonly used in an illumination system to focus radiation, thereby increasing efficiency of the illumination system.

9. Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Singer as modified by Wangler as applied to claim 63 above, and further in view of Sandstrom et al. (US PGPub 2002/0105629, referred to as Sandstrom hereinafter).

**Regarding claim 64**, Singer as modified by Wangler does not explicitly disclose wherein the optical structure is a diffractive optical element.

However, Sandstrom discloses wherein the optical structure is a diffractive optical element (para. [0021], computer generated diffractive elements are used in the illumination system to reshuffle the illumination beam).

It would have been obvious to one skilled in the art at the time of the invention to have included a diffractive optical element as taught by Sandstrom, as the optical structure in the illumination system taught by Singer as modified by Wangler since a diffractive optical element in an illumination system is commonly used to impart a required angular distribution on an illumination beam in order to improve the quality of the illumination beam for the desired purpose of the beam.

10. Claim 66 is rejected under 35 U.S.C. 103(a) as being unpatentable over Singer as modified by Wangler as applied to claim 47 above, and further in view of Aiyer (US PGPub 5,453,814).

**Regarding claim 66**, Singer as modified by Wangler does not explicitly describe wherein the optical modulation device is an electro-optical element and the array of

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individual elements is selected from the group consisting of controllable diffraction gratings and acousto-optical elements.

However, Aiyer discloses wherein the optical modulation device is an electro-optical element (Bragg cell array 30, Fig. 2) and the array of individual elements is selected from the group consisting of controllable diffraction gratings and acousto-optical elements (Figs. 2 and 3, and col. 3, lines 63-67 and col. 4, lines 15-25, individual elements of Bragg cell array 30 are acousto-optical elements which activate when voltages are applied to the cells).

It would have been obvious to one skilled in the art at the time of the invention to have included an array of acousto-optical elements as taught by Aiyer, as the optical modulation device in the illumination system taught by Singer as modified by Wangler since an array of acousto-optical elements is commonly used in an illumination system in order to prevent optical interference between overlapping beam segments which would create undesired optical fringe patterns (col. 4, lines 55-60).

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ozawa (US Patent No. 5,574,537) discloses an acoustic optical modulator in an illumination system in an exposure apparatus.

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Eggers et al. (WO 003/36470) discloses an exposure device with a light modulator that consists of a micro-mirror array.

Grier et al. (US Patent No. 6,055,106) discloses a diffractive optical element made of an array imprinted with computer-generated holographic patterns.

Bernal et al. (US Patent No. 6,281,993) discloses an axicon between a light source and a spatial light modulator.

Sandstrom (US Patent No. 6,285,488) discloses reflective spatial light modulators in a micro-mirror array.

Schultz et al. (US Patent No. 6,295,122) discloses zoom axicons in an illumination system in an exposure apparatus.

Weiner (US PGPub 2002/0060760) discloses a spatial light modulator which transmits light to a diffractive optical element.

/C. R./  
Examiner, Art Unit 2851

/Diane I Lee/  
Supervisory Patent Examiner, Art Unit 2851